Design and Implementation of Medical Information Systems
For Managing and Following up Work Flaw in Hospitals and Clinics

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Abstract: Problem statement: This research study deals with the problem of maintaining data, deemed to be one of the biggest problems of health entities. Most hospitals and clinic suffer loss of data saved in this databases and unavailability of strong cohesive information systems. **Approach:** Our need for such databases and information systems motivates us to seek solutions and technologies that might enable us accomplish and complete our works easily and fast. **Results:** Potential medical system is deemed as one of the unique systems that attempted to reach solutions for some problems faced by leaders and decision makers and by those concerned with medical information systems proposed systems has been structured utilizing Oracle database. **Conclusion/Recommendations:** Structure of this system focused on connecting it to internet, due to unlimited e-services provided by this international network that facilitates. Accordingly this facilitates exchange of medical information to all beneficiaries.

Key words: Oracle database, web-based, Laboratory Information System (LIS), Organization for Standardization (ISO), Hospital Information Systems (HIS), Picture Archiving and Communication System (PACS)

INTRODUCTION

Process of developing medical information systems is deemed to be one of the most critical objectives for professionals in this domain. It is known that any information systems are in need for development and processing in all contingent work problems. This proposed system had been structured several years ago and had been experienced in several hospitals and clinics in Saudi Arabia. This research discusses how to utilize modern technologies available and how to use Oracle databases in saving all medical information and data that might be used. Design of this software allows easy and fast reach to information and hence fast execution of orders and easy recall for patients' information. One of the core objectives is to support receptionists, physicians, nursing, laboratory and radiology staffs in hospitals to exchange data and information is deemed to be one of the most important objectives and priorities. This is due to importance of time that helps decision makers implement necessary and most appropriate procedure for patient, especially if provided by internet. Oracle databases facilitates sharing required data and information easily and fast at any time and subject to authorities and powers vested to each user of such potential information systems. as a fundamental tool to analyze the data gathered by Hospital Information Systems (HIS) and obtain models and patterns which can improve patient assistance and a better use of resources and pharmaceutical expense (Riano *et al.*, 2000). From a managerial perspective, understanding the hospitals cost structure and their inefficiency in utilizing resources is crucial for making health care policies and budgeting decisions. The cost of medical services in hospitals is likely control by higher operational efficiency and to provide more affordable care and improved access to the public (Hollingsworth, 1999). And provide application-level interface for managing readers and process large volumes of RFID data for their medical applications. This layer is also monitoring physical layer components and supports International Organization for Standardization (ISO) standard (Glover and Bhatt, 2006). Thus, the success of e-health depends critically on the collection, analysis and seamless exchange of clinical and medical information or knowledge within and across the above organizational boundaries (Bose, 2003). Developing programming and information systems are considered the most important goals sought by everyone. Most information systems are modified and developed in order to keep up with work needs and meet the needs of all people (Hassan, 2010).

MATERIALS AND METHODS

Structuring potential medical information systems, gave due concern to satisfaction of all prerequisites of

respective people and departments of medical professions. This included receptionists, file registrations, doctors' data, deciding times for inspection, supporting nurses to register their primary notes concerning patients, before referring them to concerned physicians; registering all medical analyses of the laboratory, in information systems, printing results, delivering them to patient, or keeping them in files, registering data about radiology and radio images needed for a certain patient, as requested by attendant physician in addition to various and diverse processes managed by such systems inside hospitals or medical entities concerned with using such systems. Oracle databases supported all professionals in this field, either as programmers or databases developers to maintain and manage information easily and fast and hence deliver them to those needing or requiring them as soon and easy as possible. This is guaranteed through the big amount of reports structured and added to medical information systems after being duly tested and commissioned in several hospitals and medical organizations. On the ground, however, HIS and especially hospital information systems development in developing countries has proven difficult due to organizational complexity (Littlejohns *et al*., 2003). Now there are HIS, Radiology Information System (RIS), Laboratory Information System (LIS) and Picture Archiving and Communication System (PACS) in many bigger hospitals, each system run independently in most hospitals. With the development of health researches and health standardization, this problem can be solved Chang *et al*. (2003) in the future, for the sake of medical information sharing, teleconsulation, hospital efficiency enhancement, medical service extension, optimizing the working procedure (Haux, 2006). In order to successfully exploit the social and economic benefits that are emerging as a result of E-healthcare, it is important to fully understand the developments in technology, social considerations, government fiscal policy and business objectives (Bali, 2000). E-Healthcare is fast becoming an important issue, as managers are under increasing pressure to provide cost-effective healthcare. Workflows and associated internet technologies are being seen as an invaluable means to cut administrative expenses. One way to provide cost-effective healthcare, without compromising on quality, is to use IT implementations such as workflow tools which are designed specifically to automate the electronic paper flow in a managed care operation-thereby cutting administrative expenses (Latamore, 1999). These systems include electronic health records, medical knowledge bases, prescription ordering and clinical decision support systems. The availability of theses e-health applications has introduced an opportunity for systems designers to develop integrated KMSs that can support the full spectrum of knowledge needs in nursing process. In fact, the use of knowledge-based IT to facilitate the practice of health care promises to substantially improve health care quality (Jadad *et al*., 2000).

RESULTS

- Potential information systems had been designed based on Oracle databases
- Data entry forms had been designed through oracle developer enabling entry and registration of all information and data in computer database
- It provides a number of reports showing daily movement and work flaw
- It provides availability of extracting charts from information systems
- It provides an integrated system for managing and following up users of medical information systems
- Information systems might be utilized through internet-based ASP forms
- Medical information systems include systems for following up doctors, nurses and patients
- It enables users of medical information systems to exchange data easily and fast

DISCUSSION

Potential medical information systems passed many phases the first of which is: collecting data and information on currently available medical systems; them the second phase comprised in making studies about such information; the third phase is converting such information into oracle-based databases; the fourth phase of structuring entry forms ORFMS using Oracle Developer. This methodology is selected due to strength, power and high speed and to accuracy in conclusions reached. He firth phase is structuring reports necessary to express daily work flaw and hence support decision makers take correct and accurate decision that elevates potentiality and develops works. The fifth phase is the one concerned with structuring reports required to reflect daily work flaw and hence take correct and most accurate decisions that guarantee elevating wok efficiency and professionalism. The sixth phase is training; in this phase users are trained to methods of utilizing potential information systems for acquisition of potentialities enabling them follow up and manage work flaw. The seventh phase is concerned with taking notes and suggestions of respective professionals processing work through medical information systems, studying them, attempting to implement them and adding them to medical information systems.
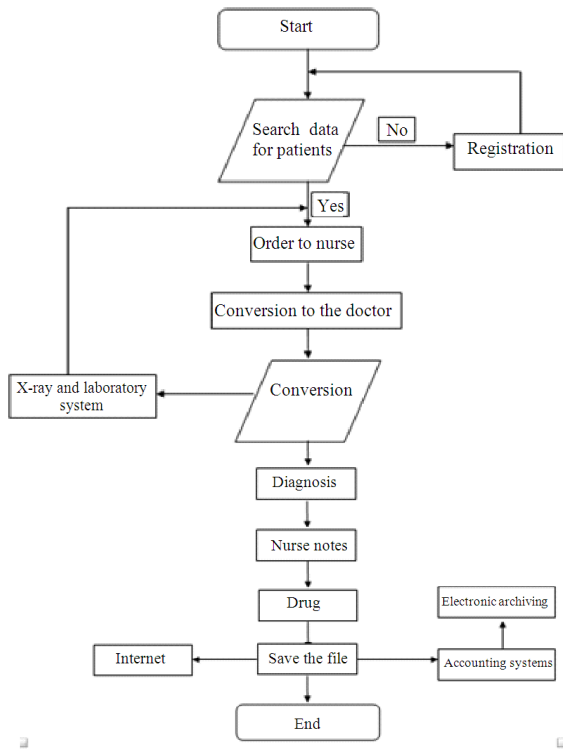
Fig. 1: System flow chart

Fig. 2: System processes

The eighth phase is concerned with developing medical information systems to cope up with enormous developments in IT domain. Fig.1 flow chart for following up health operations concerned with patients, Fig. 2 processes of information systems to internal systems of hospitals, Fig. 3 Analysis Types Report (Laboratory). Figure 4 Patients Data Form and new file entry and opening.

Test Code	Test Name	Normal Result
1001	Blood Urea	10 - 50 mg/dl
1002	B.U.N.	5 - 23 mg/dl
1003	s.Creatinine	M 0.7 - 1.4 mg/dl F 0.6 - 1.2 mg/dl
1004	Uric acid	M 3.0 - 7.0 mg/dl F 2.5 - 6.0 mg/dl
1005	Total Lipids	500 - 600 mg/dl
1006	s.Cholesterole	140 - 220 mg/dl
1007	s.Triglycerides	40 - 160 mg/dl
1008	s.HDL	M 30 - 70 mg/dl F 30 - 85 mg/dl
1009	s.LDL	65 - 175 mg/dl
1010	s.Iron	65 - 170 u g/dl
1011	s.T.I.B.C.	250 - 450 ug/dl
1012	s.Sodium	136 - 146 mEq/L
1013	s.Potassium	3.4 - 4.5 mEq/L
1014	s.Calcium	8.4 -10.2 mg/dl
1015	s.Total Protein	5 -8 g/dl
1016	s.Albumin	3.5 - 5.5 g/L
1017	A/G ratio	1.1 1.8/1
1018	Total bilirubin	up to 1.0 mg/dl
1019	Direct bilirubin	up to 0.25 mg/dl
1020	sGOT (AST)	M up to 37 F up to 31
1021	sGPT (ALT)	M up to 37 F up to 31
1022	s.Alkaline Phosphatase	30 - 85 IU/L
1023	s.Acid Phosphatase	0.5 - 11 IU/L
1024	LDH	90 - 200 IU/L
1025	CPK	M 25 - 130 U/L F 10 -115 U/L
1026	s.Amylase	0.8 - 3.2 IU/L
1027	s.Gamma G.T.	M 9 - 50 U/L F 8 - 40 U/L
6001	RBCs	M 4.5 - 6.5 mil/cmm F 3.8 - 5.8 mil/cmm
6002	- HB	M 13 - 18 g/dl F 12 - 16 g/dl
6003	- Hct	M 40 - 54 % F 37 - 47 %
6004	- MCV	MF 76 - 96 fl
6005	- MCH	MF 27 - 32 pg
6006	- MCHC	MF 30 - 35 %
6007	Retics	0.2 - 2.0 %

Fig. 3: Analysis types report

Fig. 4: Patients data form

Fig. 5: Patients table in oracle SQL

Figure 5 an example for one of the tables used Patients Table in Oracle SQL. Figure 6 Primary key, unique constraints. Figure 7 Patients_Data Table unique Index constraints. Figure 8 Doctors registration form.

```
CREATE UNIQUE INDEX PATIENTS_PRIMAR_KEY
ON PATIENTS_DATA
(FILE_NO)
LOGGING
TABLESPACE SYSTEM
PCTFREE  10
INITRANS  2
MAXTRANS 255
STORAGE  (
      INITIAL      64K
      MINEXTENTS    1
      MAXEXTENTS    2147483645
      PCTINCREASE   0
      FREELISTS     1
      FREELIST GROUPS 1
      BUFFER_POOL   DEFAULT
      )
NOPARALLEL;
```

Fig. 6: Primary key, unique constraints

```
ALTER TABLE PATIENTS_DATA ADD (
  CONSTRAINT PATIENTS_PRIMAR_KEY
  PRIMARY KEY (FILE_NO)
  USING INDEX
  TABLESPACE SYSTEM
  PCTFREE   10
  INITRANS  2
  MAXTRANS  255
  STORAGE  (
      INITIAL      64K
      MINEXTENTS    1
      MAXEXTENTS    2147483645
      PCTINCREASE   0
      FREELISTS     1
      FREELIST GROUPS 1
      ));
```

Fig. 7: Patients_Data Table unique Index constraints

Fig. 8: Doctors registration form

CONCLUSION

The core objective of potential electronic system is to facilitate process of data entry and following up patients files in hospitals and clinics. This system is designed based on Oracle databases due to its excellence in capacity of data volume, number of potential users who can access to the same database at any time. It is also distinguished with availability of following up and managing work flaw in hospitals and clinics easily and fast. The process of developing software is always in need for more effort to reach the desired objectives and hence facilitate procedures and shorten time and lessen effort exerted to reach desired objectives and conclusions.

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